Azimuthal dependence of the HBT parameters and transverse expansion in Au+Au collisions at RHIC

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Anisotropic, and in particular in-plane elliptic flow, recently discovered at the AGS and SPS, is expected to be an important physics issue at RHIC as well [1]. At the same time, identical particle interferometry measurements will provide information on the geometry of the particle emission region. Taking together, these measurements would yield very important information on the geometry of the effective source as seen relative to the reaction plane of the collision. Here we discuss one of the possible qualitative results of such an analysis. Namely, it could happen, that the elliptic shape of the effective source of particle with low p_t is oriented perpendicular to the reaction plane, while at high p_t the orientation will be in-plane. The physics of this effect would be that particles of low p_t are produced from the parts of the entire source corresponding to underdeveloped transverse flow, and thus reflecting the orientation of the nuclear overlapping zone, while high p_t particles are coming from the regions of well developed flow, which areexpected to be in-plane. If observed, the effect would be strong evidence for the expansion of the system.

We check the hypothesis with the RQMD model, which we use to simulate Au+Au collisions at RHIC. As seen from Fig. 1, the in-plane expansion is very weak in this model. Still, in the centrality region of $b \approx 3$–4 fm, the source changes it's orientation with respect to the reaction plane as p_t increases. The effect is very weak, and this is probably the reason why it does not show up in the dependence on the azimuthal angle of the actual HBT parameters (Fig. 2).

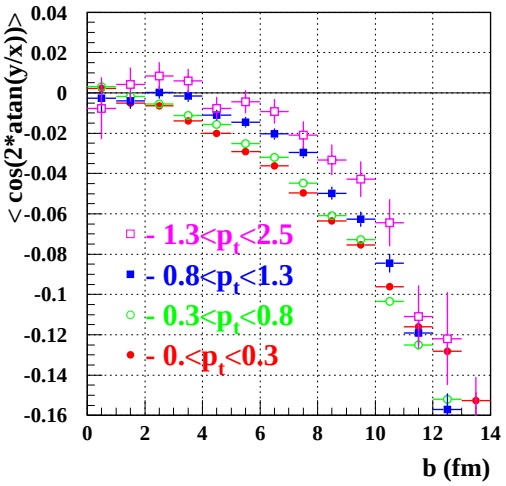

Figure 1: Elliptic anisotropy of pion source for different pion p_t regions. Pion rapidity $-0.5 < y < 0.5$.

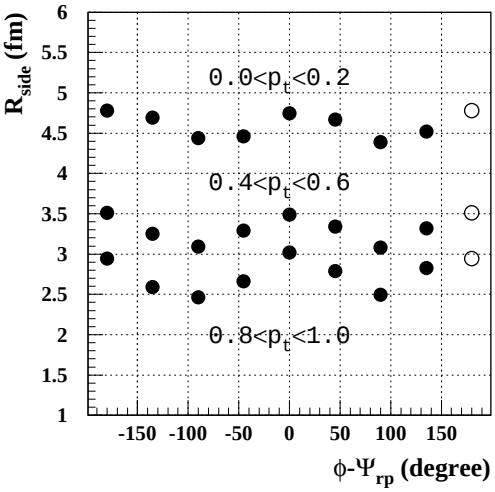

Figure 2: R_{side} as a function of pion emission angle relative to the reaction plane for three p_t regions. Impact parameter cut $3 < b < 6$. The 180 degree (open) points are the reflection of the -180 degree points.

References

[1] A.M. Poskanzer, R. Snellings, S.A. Voloshin, and N. Xu, this report.